Evaluating Medium Caliber Airburst Munitions Using an Operational Effects-Based Analysis Process

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Disclaimer

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The Requirement for Medium Caliber Airbursting Munitions

If our Armed Forces are to be faster, more lethal, and more precise in 2020 than they are today, we must continue to invest in and develop new military capabilities….The global interests and responsibilities of the United States will endure, and there is no indication that threats to those interests and responsibilities, or to our allies, will disappear.

Joint Vision 2020

Words of Wisdom on Effectiveness Methodology

The effects of gunpowder- that major agent of military activity- could only be demonstrated by experience. Experiments are still being conducted to study them more closely.

It is, of course, obvious that an iron cannonball, impelled by powder to a speed of 1,000 feet per second, will smash any living creature in its path. One needs no such experience to believe that. But there are hundreds of relevant details determining this effect, some of which can only be revealed empirically. Nor is the physical effect the only thing that matters: the psychological effect is what concerns us, and experience is the only means by which it can be established and appreciated. In the Middle Ages firearms were a new invention, so crude that their physical effect was much less important than today; but their psychological impact was considerably greater.

Clausewitz, *On War*

The Problem?

- What effectiveness criteria, specifically against Infantry, should be used to define the requirements for Airbursting Munitions (ABM)?
- Traditional Methodology
  - Probability of Incapacitation
- Proposed Effects Based Methodology
  - Based on effects on the soldiers
- A change for Current ABM Programs.
- Need a Unified Methodology.
- Should feed Live Fire Test and Test Strategies

What is Operational Effects Based Analysis?

- Effects Based Targeting Doctrine focuses on determining what effects are desired on the enemy.
  - Example- Targeting of Power Grids, TV, and Radio Stations in Belgrade to create public unrest against Milosevic
- Joint and USMC Operations Doctrine oriented on operational effects against the enemy.
- Proposed Definition- Criteria and Requirements for ABM that encompass the physical and mental effects desired against the enemy infantry squad when viewed from an Operational Perspective.
- Determine what objective effects are desired/ required on the target.
- What is the objective of the engagement?

Probability of Incapacitation

- William Sperrazza and Joseph Kokinakis - BRL Report 1269 - Jan 1965
- Assumptions made in formulation of Probability of Incapacitation- actually Average Level of Incapacitation
- Is it misused or overused in Requirements?
- Difficulty correlating Live Fire results to Probability of Incapacitation
- Is 30 second Assault and 30 second Defense Criteria still relevant?
- Are we afraid to change because it's the baseline for comparison? Or Best we Got?

Models

- **The Objective- Models are created to match the realistic environment as closely as possible and negate the need for large quantities of Live Fire data**
- **Limitations- Models are based on mathematical formulas. Certain assumptions are made by the "creator" and some are induced by the "user". These assumptions are not always apparent to the "interpretor" or "decisionmaker".**
- **Endstate- Models are not always correct**
- **Models that can support ABM in the future if enhancements are added:**
  - **ORCA, ICEM, FBAR, PIMMS**

Have You Ever Been Here?

- Out on a range conducting a live fire test on a munition. Impact on the target, devastating effects, wouldn't want to be that target.
- Data from test inserted into model, not much damage. Model doesn't account for blunt trauma, Doesn't account for whatever else.
- Is the test a failure? Is the model wrong? What do the Live Fire folks think of your test results and requirements now?
- Is this what the Requirements asked for?
- Does intuitive results supersede data collection or modeling results?

A Fact for the ABM Community

- **Several Programs in development or testing in near future**
  - **OICW - Alliant Tech- 20mm- IOC 2008**
  - **OCSW- Primex/GD- 25mm- IOC 2009**
  - **Striker ALGL- Primex- 40mm- IOC**
  - **AAAV/LPD-17- Foreign and Domestic Sources- 30mm- IOC 2007**
  - **ALACV STO (ARDEC) - transition to other calibers- 25mm to 40mm**

A Fact for the ABM Community

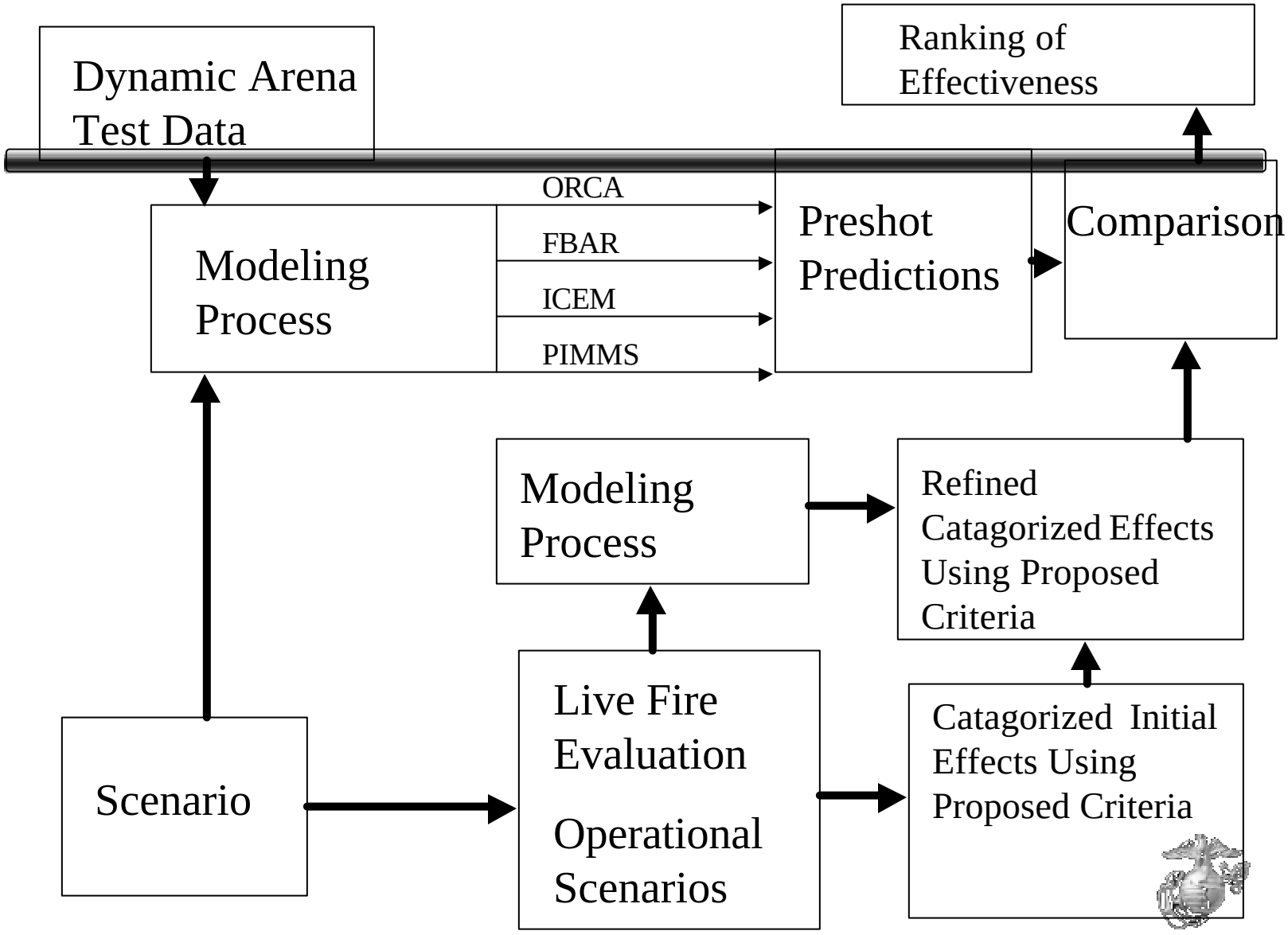
- All of these will have Live Fire oversight
- All have a difficult common target- Infantry
- All should use the same requirements methodolgies
- What are the desired operational effects from these munitions and/or systems?
- Requirements should be similar. Test methodologies should be similar
- Is the final product really what the warfighter needs?

What are the Operational Effects desired against Infantry?

- **Physical Effects- Death,wounding, loss of warfighting functionalities, inability to continue mission, perceived suppressive effects**
- **Mental Effects- Fear, Defeat, Hopelessness, Inability to continue mission, self preservation, suppression**

Turning Effects Desired into Effects Required

- **What are we trying to do?**
  - **Kill him**
  - **If can't Kill him, Wound him so he is not capable of fighting**
  - **If we can't Wound him, Suppress him so he can't fight. Convince him that if he exposes himself or moves he probably will be wounded or killed**
  - **Choices left are to surrender or die**


Dynamic Arena Test Data
Ranking of Effectiveness
ORCA
FBAR
ICEM
PIMMS
Modeling Process
Preshot Predictions
Comparison
Modeling Process
Refined Catagorized Effects Using Proposed Criteria
Live Fire Evaluation
Operational Scenarios
Catagorized Initial Effects Using Proposed Criteria
Scenario

Physical Classes

CLASS	CRITERIA	METHODOLOGY USED
1	No effect on combat functions. Zero Incapacitation. Effects- still fully functional	ORCA, ICEM
2	Less than 20% loss of combat functions. Light incapacitation, less than 20%. Effects- can perform all functions with slight degradation. Can still use legs and arms. No first aid required/Self aid only	ORCA, ICEM

Physical Classes

CLASS	CRITERIA	METHODOLOGY USED
3	Limited combat functions. Limited incapacitation 21- 44%. Effects- can perform 60% of combat functions. Limited use of legs and arms. Requires limited first aid	ORCA, ICEM
4	Residual Incapacitation. Incapacitation of 45-59%. Effects- can perform 40% of combat functions. Doubtful use of legs and/or arms. Requires First Aid	ORCA, ICEM

Physical Classes

CLASS	CRITERIA	METHODOLOGY USED
5	Functional Incapacitation. 60-75%. Can only perform 10% of combat functions. Effects- immobile, requires constant first aid	ORCA, ICEM
6	Extreme Incapacitation. 76-89%. Effects- can not perform any function except a last self defense weapon at point blank range. Requires immediate 1st Aid to save life	ORCA, ICEM
7	Deadly Incapacitation. 90-100% Effects- can not perform any function. Death imminent	ORCA, ICEM

Mental Classes

CLASS	TYPE	DESCRIPTION AND CHARACTERISTICS
1	Unaffected	Very small visual or aural signature. No casualties. Low probability of being hit by fragmentation. Low perceived probability of incapacitation
2	Apprehensive	Noticeable visual and aural signature. Minor casualties in squad. Some reluctance to take risk. Experience level will determine level of apprehension. If casualties are minor, will have acceptable level of risk and continue with combat functions

Mental Classes

CLASS	TYPE	DESCRIPTION AND CHARACTERISTICS
3	**Doubtful**	**Definitive visual and/or aural signature. Apparent danger, medium to high perceived probability of incapacitation. Reluctant to take risk; Indecisive. Will try to determine if there is other imminent danger that may be of greater risk. Casualties are not severe but have significant injury.**
4	**Fearful**	**Significant visual and/or aural signature. Single major casualty in squad that requires first aid and medevac; some minor casualties. Demonstrated lethal effects. Perceived probability of incapacitation high. Very reluctant.**

Mental Classes

CLASS	TYPE	DESCRIPTION AND CHARACTERISTICS
5	**Scared**	**High Level of visual and/or aural signature. Definite danger, High perceived probability of incapacitation. Multiple casualties in squad requiring first aid and medevac. Shock, bewilderment. Situation out of control. Loss of squad mission mentality.**
6	**Frozen**	**High Level of visual and/or aural signature. Fatal and Multiple serious casualties. Chaos. Immobile. Complete loss of mission mentality and structure.**

Example- Physical Engagement

- 8 man infantry squad in a 10 X 50 meter area, good dispersion
- Gunner picks an aimpoint within squad for a 3 round burst in a “string of pearls” sequence at a range of 1700 meters
- Each round has lethal fragments that are effective up to 8 meters with protective vests and helmets
- 5 of the 8 are hit; In the Physical categories they are:
  - Two are class 6
  - Two are class 5
  - One is class 4
  - One is class 2
  - Two are class 1

Example- Mental Effects

- Squad is functionally at 50% effectiveness because four of the members are ineffective
- What is the state of the remaining four?
  - Immediate action is prone position
  - Perhaps no idea exactly where rounds came from. If they did see the barrel flash/smoke…no organic weapon capable of engaging AAAV
- Choices?
  - Provide first aid to four injured squad members?
  - Move to safe cover?
  - Stay where the are?
  - Perceived level of Probability of incapacitation High
  - Defend, Delay, Withdraw, or Surrender?
- Mental Category is Class 5

Example

- **Physically Class 6**
- **Mentally Class 5**
- **Still undecided if there is a weighting to the scores**
- **Utilize criteria to establish ABM operational effectiveness desired.**
- **Utilize criteria to compete ABM in an operational effectiveness role.**

Summary

- A Proposed method of determining ABM requirements and test criteria. Provides a “window” of performance. Uses multiple tools to evaluate.
- Focuses on Operational Effectiveness vice Scientific Effectiveness. Utilizes all the attributes of the battlefield.
- Still leaves some subjectivity. But this will be minimized as descriptive criteria is enhanced. Total methodology not fully complete.
- In my opinion, will be better for both government and industry.
- Allows competitive ABM’s to be rated against one another in the effects catagory
- My goal is to continue to work this effort. Feedback is welcome. Tentative ABM Symposium hosted by AAAV in the May-June timeframe will elaborate further.

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